Comments from NuMI Infrastructure Review
Part I
July 12, 2001

Responses by Bruce Baller
May 7, 2004

Water Inflow
Presenter: J. Sollo

1. (Reviewer: D. Capista) The ground water collection and discharge designs leads me to several concerns: First, I think the under drain system using the geo-composite strip and PVC will plug up with mud and silt over time. When this drain saturates with water the water will end up in the tunnel. It my be better to consider a drainage pipe that would run the length of the tunnel. One could then collect the water at various locations and pump it into the pipe. Secondly, the discharge of the ground water is located at the deepest part of the tunnel. This is good for collection but will have about 175 PSI of head pressure. I know it is possible to pump with this head pressure but the pumps must be expensive and costly to maintain and operate. If possible consider a second pumping station at the target hall. I believe the initial investment will be worth it in costs later.

Care is required to ensure that the drains are kept clear of mud and debris. Underground workers are regularly reminded of this concern.

2. (Reviewer: S. Childress) No drip ceiling is currently specified for electronics racks (for muon monitoring, absorber, control) near the upstream of the access tunnel to the absorber. Possibly this might be dry; if not we need equipment protection from water.

Localized drip ceilings have been installed in all rack and panel board locations.

3. (Reviewer: J. Hylen) Since overhead drip shields in the absorber vacuum pump area are not in Healy contract, must remember to put them in outfitting contract.

The RAW and vacuum skids were designed with drip ceilings.

4. (Reviewer: D. Johnson) Since the ground water is mostly directed toward the MINOS hall, I think it may be a good idea to reconsider the third high level sump. We have had two bad sumps in a pit in the past.

There are 3 sump pumps and an emergency diesel powered pump. A fault analysis was performed by an outside contractor and preventive measures taken to ensure reliability.

5. (Reviewer: D. Plant) I have some questions and concerns about the water inflow mitigation for the NuMi tunnel. At one time I believe, there was at least one

additional sump pumping station at the downstream end of the Carrier pipe. This pump was located around the target area and the water was exhausted up the target shaft. Using your numbers for water inflow, a pumping station there would alleviate ~33% of the total water inflow. The water pumped would be more easily removed at this depth, than if it were allowed to run clear to the end of the enclosure. Also in case of a total pumping failure at the far end, a pumping station at the target area would give you 33% longer "dry" time before we start to flood down in the MINOS area. If there are any problems with this ¾" water passage, they would not be near as severe if there were this upstream sump station.

OK

6. (Reviewer: D. Plant) We may need to think about the mechanisms that may clog up this ¾" drain-way. We know we have brown micro organism that grow in and clog up many of our slower moving or intermittent lines regularly. Initial construction waste may also be a source of material that will plug up this system.

See above response.

7. (Reviewer: D. Plant) I would suggest complete redundant systems at the MINOS area for the sump system. Completely separate pumps, feeds, piping, and circuits. This my be a weakness in the system that will be exploited by mother nature and Murphy's law. We have seen many "off beat" failures with pumping, piping and electrical system here in the last 25 years. It would not be to difficult to come up with a scenario that would flood the MINOS area without this complete backup system. One other possibility to mitigate this would be a larger/deeper sump area. We may consider enough water retention (sump pit) for 8-12 hours of sump system failure using the predicted inflow numbers.

Done.

8. (Reviewer: D. Plant) If all of the ground water is pumped out at this one point it will generate 1acre/ft each 40 hours. Do we have a place or permits to dump that much water?

The ground water is injected into the laboratory ICW system.

9. (Reviewer: D. Plant) There was mention of areas of the tunnel where no drip roof was to be installed and that stainless water pipes were to be installed. In the past we have experienced small water leaks that have leached through concrete and literally eaten holes in our SS vacuum and water pipes. I would strongly urge that no piping, cable tray, or bracketing be placed in what would be predicted to be a "wet" environment with N% wet wall or ceiling predicted. Also no lighting was to be installed in some of these same areas. If there is one pipe, one cable, one cable tray, or one piece of conduit in a tunnel, it will need servicing.

We should consider some minimal incandescent lighting be installed. Workers may still be forced to carry there own light when any work or inspection access is done, but some minimal service should exist.

Done.

10. (Reviewer: R. Rucinski) It was mentioned that the natural level of ground water at Fermilab has dropped due to NUMI water in-leak. It should be considered if this is having a collateral effect on other Fermilab cooling systems that use retention ponds. Is the level of cooling ponds dropping also, pulling silt or muck into the water that is accelerating the clogging of filters and equipment? I have heard one mention of the need to dredge the cooling water system that goes around the ring and an observance of more plugging problems in accelerator components. It should be considered whether it is related to the Numi tunneling activity.

We do not believe that the NuMI facility has had any negative effect on existing laboratory water-cooling systems.

11. (Reviewer: R. Rucinski) I worry about the construction phase right now, before all the pump redundancy and back up is in place. Can a failure now cause flooding and drowning of workers?

Flooding was a concern for the excavation sub-contractor, however the risk of drowning was negligible given the large volume of the underground areas.

HVAC
Presenter: L. Hammond

1. (Reviewer: D. Capista) The air system looks like it is about all that can be costed in this project. I am concerned that in order to meet the design of this system, the tunnel is assumed to have 3% wetting. I suspect this number represents the best the tunnel will be and during wet seasons I am concerned the wetting will be much higher, 10-15%? The backup plan for humidity is to install dehumidifiers. Where will this water discharge to? If it is put on the floor it will only evaporate back into the air. These tunnel environmental issues are very important and should be further reviewed. If the humidity in this tunnel is high, Magnet, power supply, and vacuum failures will occur at a much higher than normal frequency. The reliability of the experiment will suffer if the tunnel humidity design is not met.

The relative humidity in the underground areas is ~50%. If local humidifiers are deemed necessary the water will be routed to the gutters.

2. (Reviewer: S. Childress) For the carrier tunnel, it would be very good to control condensation to the extent possible for equipment protection - especially the thin

wall stainless carrier pipe. My understanding is that currently planned is a ventilation air duct moving air to an exhaust upstream of the carrier tunnel. Can we instead use the carrier tunnel itself as the duct? This should greatly control water in the lined portion.

Done

3. (Reviewer: S. Childress) Do we have a back-up capability for tunnel heating - such as electric unit heaters - to keep above dew point when air circulation system is down?

The air circulation system should rarely be down and should be repaired promptly for life safety reasons.

4. (Reviewer: J. Hylen) Target Hall needs a humidity spec that will preserve crane. The current baseline air handling system may do this, but it would be good to clean up this spec.

OK

5. (Reviewer: D. Plant) Is it a fact (I may have missed this) that no humidity control will be implemented in the bypass tunnel. If equipment such as vacuum pumps are placed there it would be very rough on the equipment.

There is airflow through the bypass tunnel that should be adequate to control the humidity.

6. (Reviewer: D. Plant) The numbers used for wall wetting, 2%. Is this number generated by testing or calculation or supplied by an outside consultant? If the number is really 10% the existing humidity removal system may not keep up.

The wall wetting is probably closer to 10% in some areas, however the humidity levels are acceptable.

7. (Reviewer: R. Rucinski) Should there be a concern of a bad type of mold growing in the moist tunnel that could cause health problems?

Not that we are aware of, however this should be monitored in the future.

8. (Reviewer: R. Rucinski) I would think it would be prudent to have some permanently mounted air-sampling monitors, (like the kind used for confined space entry, ie. TMX410) in the areas or on the exhaust from areas that will be inhabited. There could be some unknown source of oxygen depletion or poisonous gas, or flammable gas. Expect the unexpected.

The rock in this area is not coal-bearing and no poisonous gases are expected (or seen). Furthermore, most interior portions of the underground area are covered with shotcrete preventing gas infiltration.

Fire Protection
Presenter: L. Hammond

1. (Reviewer: R. Rucinski) Will radiation interfere with the smoke detectors?

The smoke detectors are VESDA systems with the active components outside the radiation area.

Electrical Plan
Presenter: B. Ducar

1. (Reviewer: D. Johnson) There was concern raised about being in complete darkness until the generator kicks in. We have used the "glow in the dark" paint or tape in a few areas around the lab and it seems to work well. It is charged by the normal lighting and is there when you need it. The cost was high years ago, but it may have come down by now. Once again, we have had backup generators/transfer switches fail when needed and during their scheduled test periods.

Underground workers are required to have a flashlight in their possession.

2. (Reviewer: R. Rucinski) From a simplistic point of view, water and electricity don't mix. Water and oxygen accelerate corrosion and water can conduct electricity. Basements are required to have ground fault circuit interrupters to prevent electric shocks to users. What precautions are taken to prevent shock hazards to personnel?

Electrical systems in the underground areas are installed per applicable codes.

Enclosure Access
Presenter: B. Ducar

1. (Reviewer: P. Martin) There are two issues associated with the recommendations of Gage Babcock. The first is occupancy limits…that the total number of personnel working below grade in any area should not exceed the capacity of two elevator loads. There was brief discussion of when this requirement would become effective. In my opinion, there is no doubt that it should be at the time the NuMi project receives beneficial occupancy of the underground areas. That is, at the time the installation activities begin. However, this will place restrictions during the installation phase, and it is important for the project to understand these issues. The integrated installation schedule that has been discussed at previous reviews should be completed, with estimates of manpower

for each installation task, by area (MI area, target area, etc.) so that the access issues can be understood.

Access limitations are included in all installation considerations in the downstream area.

2. (Reviewer: P. Martin) The other issue was the method of recording entry and exiting from the underground enclosure. This also needs to be in place at the time installation begins, and the means by which this will be done needs to be agreed upon among the various groups, including DOE, ES&H Section, and the NuMI project.

A badge system is used to control the number of underground workers.

3. (Reviewer: D. Plant) Should cameras be use to inspect some of the more remote areas like the access for the carrier pipe?

Cameras will be used in certain circumstances.

Radiation Safety
Presenter: N. Grossman

1. (Reviewer: S. Childress) Projections for tritium levels in the horn raw systems exceed Lab guidelines by a very large factor (~ 30,000). As I believe is already underway, detailed plans for working with these levels need to be compiled and input to a formalized review process. It is important to preclude major surprises occurring as we approach operation.

Kamran Vaziri of the ES&H Section has estimated tritium levels. Procedures will be put in place to ensure compliance with lab guidelines.

2. (Reviewer: J. Hylen) The second permanent stack monitor may more sensibly be placed on the hadron absorber vent than the primary beam carrier pipe vent.

Done

3. (Reviewer: D. Plant) Some power supplies are cooled by the RAW water system. I would suspect that the rooms where these supplies are located will need to be radiation interlocked.

Power supplies are cooled by LCW systems, not RAW systems. All RAW systems are in areas where access is controlled.